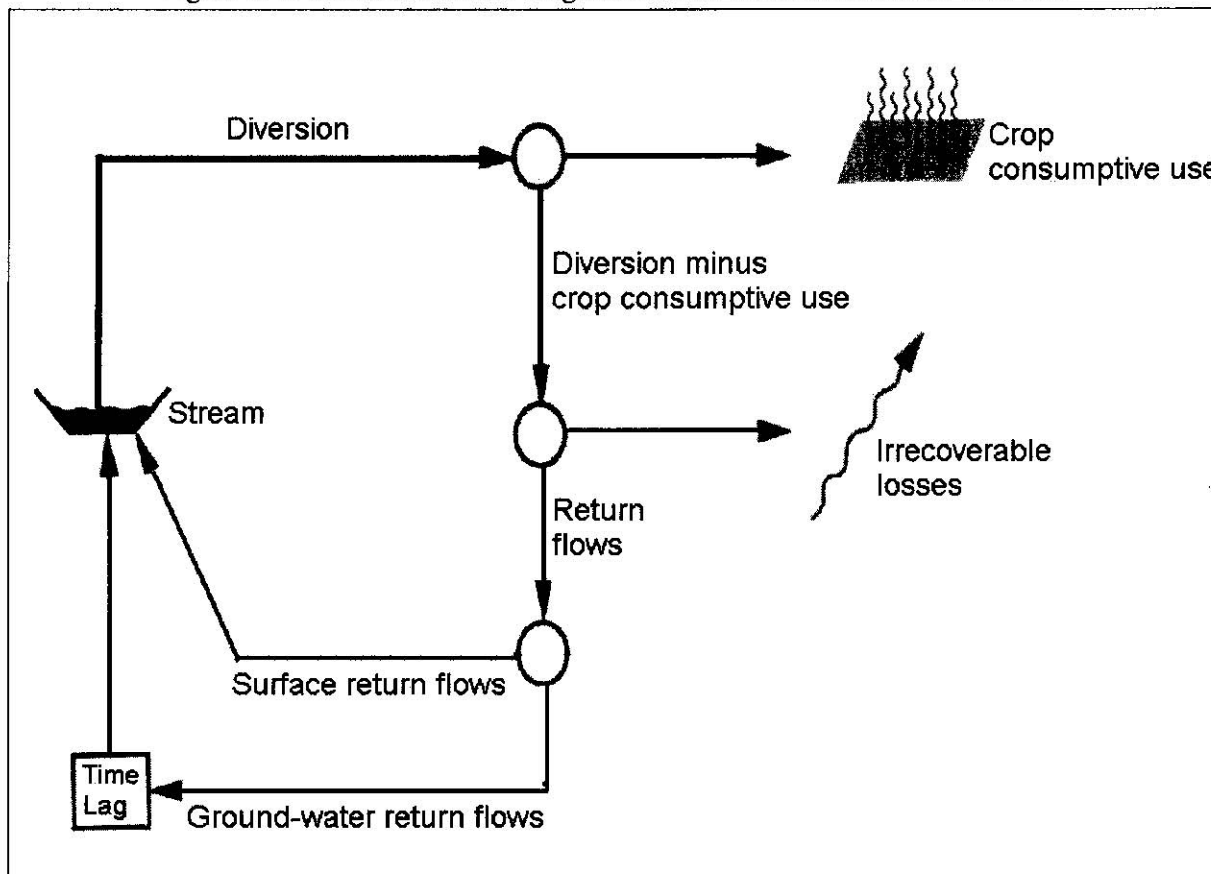


## Appendix D: Smith River Basin Surface-Water Model

DNRC put together a computer spreadsheet model of the upper Smith River basin to simulate what effect the proposed projects and changes in irrigation practices would have on stream flows. The input data to the model were estimated streamflows from 1978 to 2001, irrigated acres during the same period by system type, irrigation system efficiencies, and ground-water return flow factors. Figure D-1 is a diagram of how the effects of irrigation water use on streamflows are modeled.

Figure D-1. Schematic of how irrigation effects on streamflows are modeled.



As input to the model, DNRC used the irrigation efficiencies presented in Table D-1. These efficiencies are considered averages, and there is no doubt a lot of variability between systems and irrigators. The efficiencies were selected after reviewing those used in previous water models for the Missouri basin, and through discussions with professionals who are familiar with irrigation efficiencies.

Table D-1. Summary of irrigation system water use characteristics used in modeling the upper Smith River basin.

Type of Irrigation System	Percent of Water Diverted that is:			
	Used by Crop	Surface Return Flow	Ground-water Return Flow	Lost
Full Service Flood	25	32	33	10
Partial Service Flood	20	35	35	10
Center Pivot Sprinkler	65	5	20	10
Other Sprinkler	55	5	30	10

The irrigation water-use efficiencies are basin-wide total efficiencies, which include both conveyance system and field efficiencies. To some, the efficiencies used, especially for sprinkler systems, may appear low. It could be argued, for instance, that some center-pivot sprinkler systems are far more efficient than 65 percent. And this could be true for an individual system. However, the water for many relatively “efficient” sprinkler systems is still initially supplied through unlined canals and ditches, and losses from these unlined ditches can be quite high. Therefore, much of the initial loss may occur before the water even reaches the irrigated field.

In the model, surface-water return flows are modeled to return during the same month as irrigation. Ground-water return flows from irrigation during a month are lagged over the 12 months following irrigation using the factors presented in Table D-2. These factors are basin-wide composite factors that were calculated by weighing more subbasin specific factors based on the relative proportion of the total basin acres irrigated in that subbasin. The procedures used in calculating these type of factors are described in more detail in Appendix C.

Table D-2. Summary of ground-water return flow factors that were used in modeling the upper Smith River basin.

Month after irrigation	1	2	3	4	5	6	7	8	9	10	11	12
Percent of water returning	30.6	21.0	10.9	7.7	5.9	4.8	4.1	3.6	3.2	2.9	2.7	2.6

Crop irrigation requirements were estimated by starting with results for maximum potential crop water use using the NRCS TR-21 program for wet and dry years, and adjusting those water uses based on actual crop yields, and irrigation down time due to haying. July and August crop irrigation requirements, for both flood and sprinkler systems, were reduced by 25 percent to account for haying. Crop irrigation requirements for flood irrigation systems were further reduced by 40 percent because hay yields are usually much lower for flood irrigation systems than for sprinkler irrigation systems--for instance, hay yields may increase from 2 tons to acre under a flood system, to 4 tons per acre with a sprinkler system. The crop irrigation water requirements that were used are in Table D-3. When these values were calculated, it was estimated that an additional 6 inches of moisture would be available to the crop from precipitation during normal years, and that 4.7 inches would be available during dry years.

Table D-3. Crop irrigation requirements in inches that were used in modeling the upper Smith River basin.

Wetter Years	May	June	July	August	September	Total
Flood	1.16	1.88	2.66	2.12	1.04	8.86
Sprinkler	1.94	3.14	4.43	3.53	1.73	14.77
Drier Years						
Flood	1.39	2.11	2.74	2.21	1.16	9.61
Sprinkler	2.31	3.51	4.57	3.68	1.94	16.01

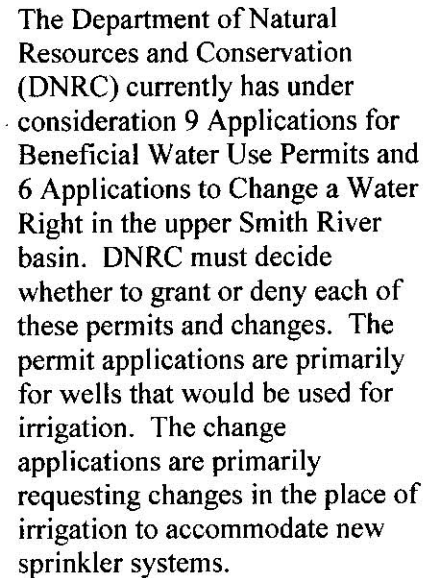
From 25-to-35 percent of the flood irrigated acres in the basin were estimated to be partial service. These are lands that would not be irrigated after the first cutting of hay. The annual crop irrigation requirement was modeled as being applied to these fields as follows: 15% during April, 40% during May, and 45% during June.

## List of Preparers

Andy Brummond	- Chapter 1 and irrigation practices
Tim Bryggman	- Economics
Larry Dolan	- Surface-water resources and water quality
Russell Levens	- Ground-water resources
Mike Roberts	- Fisheries
Bill Uthman	- Ground-water resources



# Smith River Basin Permit and Change Applications Supplemental Environmental Assessment



action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type. Because the proposed permits and changes are under consideration at the same time they must be evaluated together.

1

### ***Background of Water Rights in Montana***

Water rights in Montana are guided by the Prior Appropriation Doctrine, that is, first in time is first in right. A person's right to use a specific quantity of water depends on when the use of water began and the extent of the water use. The first person to use water from a source established the first right, the second person could establish a right to the water that was left, and so on. During dry years, the person with the first right has the first chance to use the available water to fulfill their right. The holder of the second right has the next chance. No preference is given to any particular type of water use.

The 1993 Montana Legislature closed the upper Missouri River basin including the Smith River basin to new surface-water permits. DNRC may not process or grant permits in this area with some exceptions for ground water and non-consumptive uses. The law defines ground water as water that is beneath the land surface or beneath the bed of a stream, lake, reservoir, or other body of surface water and that is not immediately or directly connected to surface water.

### ***Basis of Decision***

This EA covers a wide range of potential impacts. The decision to grant, modify or deny a permit or authorization to change is always based only on the criteria found in section 85-2-311, MCA or section 85-2-402(2), MCA respectively.

### ***Who wrote the EA?***

An interdisciplinary team made up of DNRC staff including surface-water and ground-water hydrologists, an economist and a water resources specialist wrote the EA.

### ***Public Concerns***

The public was notified that DNRC would be preparing this supplemental EA through newspaper articles, letters sent out to concerned parties and through a public meeting held in White Sulphur Springs. DNRC heard many comments at the public meeting and also received many letters commenting on the cumulative impacts of the 15 applications. By reviewing these comments the DNRC team identified the following broad areas of concern to be studied as cumulative impacts in the EA:

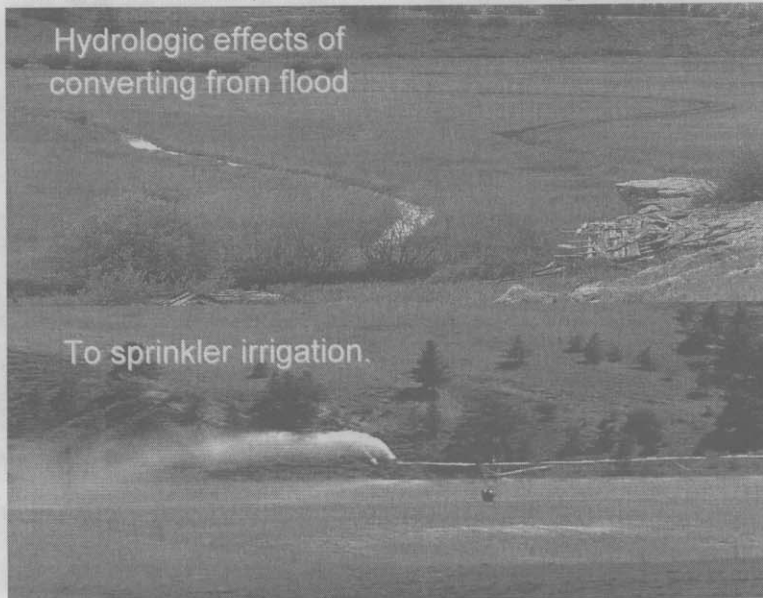
- Land Use: Irrigated Lands & Irrigation Practices
- Ground Water
- Surface Water
- Water Quality
- Fisheries
- Economic Impacts – Agriculture, Recreation, Hydropower, Taxation, Socioeconomics

### ***Summary of Effects***

The DNRC team studied how the proposed applications and possible future projects would impact the resources listed above. Following is a summary of the impacts, although the EA itself should be read for a full understanding of the impacts.

### *Land Use: Irrigated Lands and Irrigation Practices*

Existing irrigated lands stand to be moderately affected by the proposed projects. The projects represent an increase in irrigated acres in the basin. Even though some of the applicants' irrigated acres would increase, this increase must be weighed against the probability that acres irrigated by

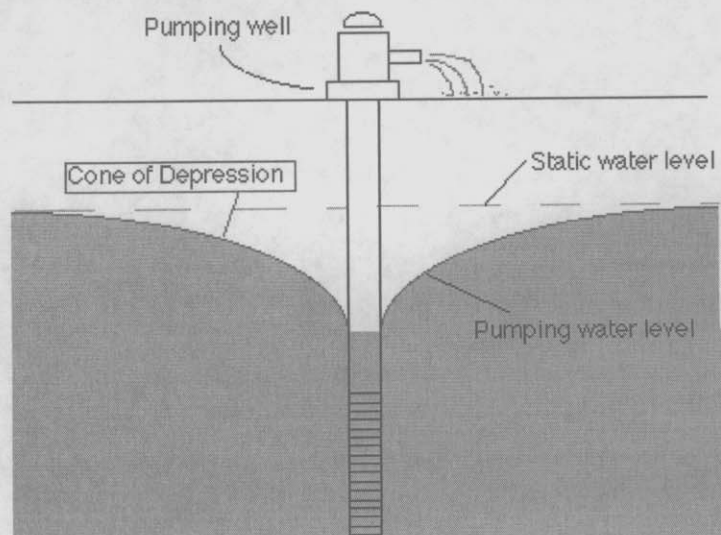


existing irrigators would at times be diminished. During dry years, the proposals would impact the ability of other existing irrigators to effectively irrigate all of their irrigated acres because of decreased streamflow.

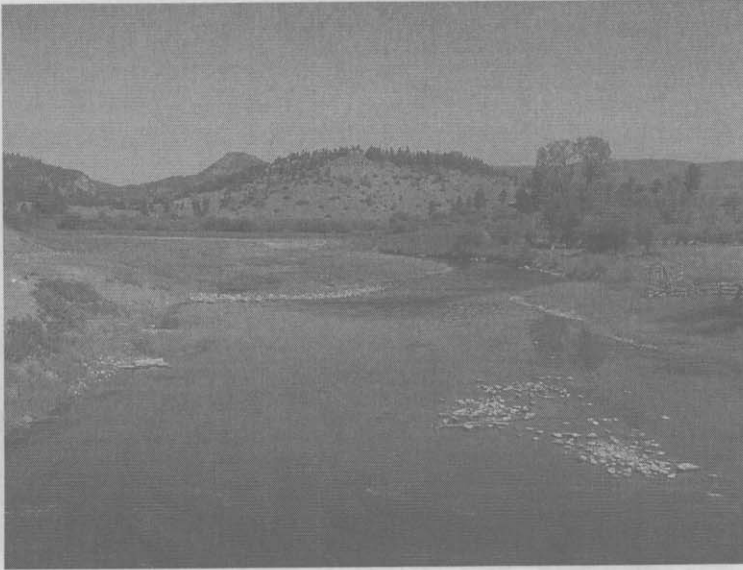
Existing irrigators have valid water rights that are protected private property rights. Under the Prior Appropriation Doctrine the impact to these private property rights must be given great consideration.

### *Ground-Water Resources*

In general, pumping a well lowers ground-water levels in an expanding circular area around a well called a cone-of-depression. When this cone-of-depression reaches another well, the static water level in that well is reduced. Whether the resulting effect on a nearby well is significant depends on whether the water column in the well is reduced sufficiently to effect production from the well. Individual projects can cause significant impacts, depending on site-specific conditions and locations of nearby wells. Closely spaced wells also can cause significant cumulative impacts if the cones-of-depression of more than one well add together. In the case of the proposed projects in the Smith River basin, the overlap of the cones-of depressions of individual wells is expected to be minor because of the relatively large distances between wells. Therefore, although individual wells might have significant impacts on nearby wells, the cumulative impact to existing ground-water users by the proposed projects is rated minor adverse. The significance of the impacts of individual projects on nearby wells is assessed in individual EA checklists.



### *Surface-Water Resources*



DNRC predicts a moderate decline in streamflows due to the cumulative effects of the proposed projects. Ground-water pumping for the proposed new permit projects would decrease streamflows by reducing the amount of ground water that flows from the aquifers to the streams. As a result of the change applications, flood irrigation systems would be converted to center pivot sprinklers and irrigated lands would be expanded. The result would be decreased streamflows, especially during late summer,

because crop water use would increase and irrigation return flows would decrease. The potential for reduced later-summer flows in the Smith River and its tributaries is a concern because water shortages already occur during the late summer of dry years.

### *Water Quality*

Minor beneficial impacts to water quality are expected to occur for the reason that irrigation return flows, which can contain nutrients and salts, would decrease. These beneficial impacts would be offset to some degree by the potential for higher water temperatures and lower dissolved oxygen concentrations due to decreased streamflows.

### *Fisheries*

The projects present a moderately adverse impact to the fishery. Reduction in streamflows would reduce fish habitat in the Smith River and some of its tributaries. The reduction in streamflows occurring between July and September are most damaging to fish because streamflows are already low during these times. Less water means less fish habitat, increased water temperatures and an increased need by fish for oxygen in the water. All of these things combined mean fewer fish can survive in the streams and rivers as the streamflows are further decreased during these critical times.

### *Economic Impacts – Agriculture, Recreation, Taxation, Socioeconomics & Hydropower*

The projects are expected to have a range of economic impacts. Some would be minor adverse impacts while others would be minor beneficial impacts. The economic impacts are divided into 5 categories.

### *Agriculture*



Farmers and ranchers putting in the new projects would experience an increase in crop production. Other irrigators may experience lower production due to the negative impacts to streamflow. The projects would increase costs due to purchasing and operating the new irrigation systems. When changing from flood to sprinkler irrigation, labor costs would be reduced.

### *Recreation*

Recreational fishing and the associated economic benefits would experience minor adverse impacts due to the projects. The negative impacts to the fishery would decrease economic benefits associated with recreational fishing.

Opportunities for floating the Smith River later in the summer and into the fall would decrease due to the decreased ground water return flows from flood irrigation and to decreased flows due to increased water use by the projects. This is considered a minor adverse impact.



Courtesy of Joe O'Neill

### *Taxation*

Overall the projects would create a minor adverse impact to property taxes collected. Because of the tax structure, fewer taxes would be collected on irrigated lands than on the same number of acres of dryland hay.

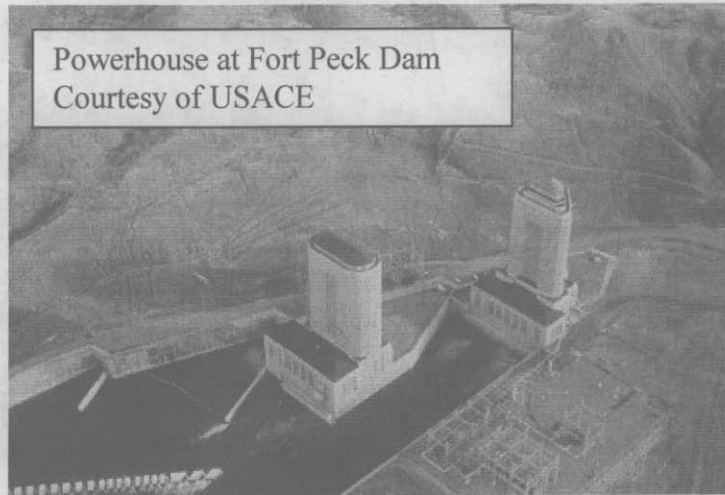
### *Socioeconomics*

Because the increase in crop production due to the projects would at times be offset by lower production by other ranchers and farmers it is difficult to gage an impact to the local economy. The projects would have minimal impacts on population, employment and income in the area.

### *Hydropower*

There would be a minor adverse impact to hydropower production because of the projects. The downstream hydropower generation dams at Great Falls and Fort Peck would generate less electricity due to decreased streamflows. The electricity that no longer would be produced could be worth as much as \$71,025 annually. The actual dollar amounts would likely be somewhat less because there is no guarantee that all the

water used by the new projects, absent their development, would reach the dams. Some of the water at times would be used by other irrigators or otherwise be lost from the river system.



### *Information and Conclusion*

This Executive Summary of the EA is intended to be a concise and easy to understand summary of the EA. The EA contains a more complete description of the proposed projects, the existing conditions or environment, the impacts to the existing environment, and the methods used to determine these impacts. It also has appendices containing more specific information regarding the specific projects, methodologies, analysis, monitoring and baseline information that was used in the development of the EA. The EA including its appendices will be available on the web at [www.dnrc.state.mt.us/smitheriverea.htm](http://www.dnrc.state.mt.us/smitheriverea.htm).

Because the conclusions reached in the EA required technical procedures and terminology, the entire EA, including its appendices, would be needed for any scientific, technical or legal review. The EA and its appendices will be sent to the people and organizations that have requested the documents. They will also be sent to all parties directly involved with the pending applications.

DNRC has determined from the analysis in the EA that no significant adverse cumulative impacts would occur as a result of the proposed projects. Because of this determination no further study of the cumulative impacts is needed. The EA will now be used in the revision or completion of EA checklists for the individual projects or applications. The individual EA checklists will contain a preferred alternative for each project and will also contain a determination of the significance of any adverse impacts associated with the specific projects.

DEPARTMENT OF NATURAL  
RESOURCES AND CONSERVATION



JUDY MARTZ  
GOVERNOR

DIRECTOR'S OFFICE (406) 444-2074  
TELEFAX NUMBER (406) 444-2684

STATE OF MONTANA

WATER RESOURCES DIVISION (406) 444-6601  
TELEFAX NUMBERS (406) 444-0533 / (406) 444-5918

48 NORTH LAST CHANCE GULCH  
PO BOX 201601  
HELENA, MONTANA 59620-1601

Notice - February 18, 2003

Enclosed are a copy of the Smith River Basin Permit and Change Applications Supplemental Environmental Assessment (EA) and an executive summary of the EA. DNRC will be holding an open-house on this supplemental EA in the City Hall Meeting Room, at 105 West Hampton in White Sulphur Springs, on March 6, 2003, from 2:00 to 6:00 p.m. The public is invited to stop by at any time during the open house to discuss the EA with the DNRC representatives who worked on it.

To comply with Montana Environmental Policy Act time limits, DNRC does not intend to revise this supplemental EA. Instead, DNRC will respond to any pertinent comments it receives in an addendum to the EA.

If you have questions regarding the EA, please call Larry Dolan of DNRC at 444-6627. Comments on the EA must be received by March 14, 2003, and can be emailed to [ldolan@state.mt.us](mailto:ldolan@state.mt.us) or sent by mail to: 20,

Larry Dolan  
DNRC Water Resources Division  
P.O. Box 201601  
Helena, MT 59620-1601.